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Design and Fabrication Report

by

Robert C. Snare

Institute of Geophysics and Planetary Physics

University of California

Los Angeles, California 90024

Final Contract Report

1 March 1977 - 30 September 1981

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1. Contract Objectives

The purpose of the contract was to develop, fabricate and test seven triaxial fluxgate magnetometer and digital data systems, for use in studying geomagnetic phenomenology.

2. Fluxgate Magnetometer

The triaxial fluxgate magnetometer followed the design of Power [1] with modifications. The modifications consisted of changing all digital functions in the field offset system from hardwired logic to microprocessor control.

The fluxgate sensors were supplied by Naval Surface Weapons Center, White Oak, Silver Spring, MD. The design was similar to that reported by Gordon et al. [2]. An additional winding was added to the sensors to provide offset field capability and extend the range of the sensors to $\pm 65,000$ nT.

3. Digital Data System

The digital data system is controlled by a RCA 1802 microprocessor. The microprocessor was programmed to control the analog to digital convertor functions, to average data and to format the serial output data stream.

The system digitized the three magnetometer signals and three auxillary inputs at 240 times per second. The data from each channel was then averaged to obtain 60 samples per second for each channel. These six main data channels are formatted together with sixteen low rate channels.

Each sample is converted to a sixteen bit digital word. The serial output data passes through a universal asynchronous receiver transmitter circuit (UART) and a modem circuit. The output data rate is 9600 bits per second. The data is carried by a coaxial cable that also carries direct current power and command information to the system. A data interface unit was developed that received data from the magnetometer units and interfaced the data to a computer for processing and storage.

3. Construction

All of the electronic circuits were packaged on printed circuit cards measuring 11.4 x 15.2 cm (4.5 x 6 in). The circuit cards that formed the microprocessor plugged into a standard digital data buss that carried address and data lines for the unit. The cards were housed in a chassis measuring 13.3 x 22.8 x 77.1 cm (5.25 x 9 x 30.35 in). A total of seven units were fabricated, tested and delivered during the contract.

References

- [1] J.J. Power, A digital offset fluxgate magnetometer for use in remote geomagnetic observatories, AFCRL-TR-0603, 1973.
- [2] D.I. Gordon, R.H. Lundsten, R.A. Chiarodo and H.H. Helms, Jr., A fluxgate sensor of high stability for low field magnetometry, IEEE Transactions on Magnetism, Vol. MAG-4, No. 3, September 1968.